



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification:

G06F 3/033, 9/44

A1

(11) International Publication Number:

WO 98/13751

(43) International Publication Date:

2 April 1998 (02.04.98)

(21) International Application Number: PCT/US97/16215

(22) International Filing Date: 16 September 1997 (16.09.97)

(30) Priority Data:

08/720,348

27 September 1996 (27.09.96) US

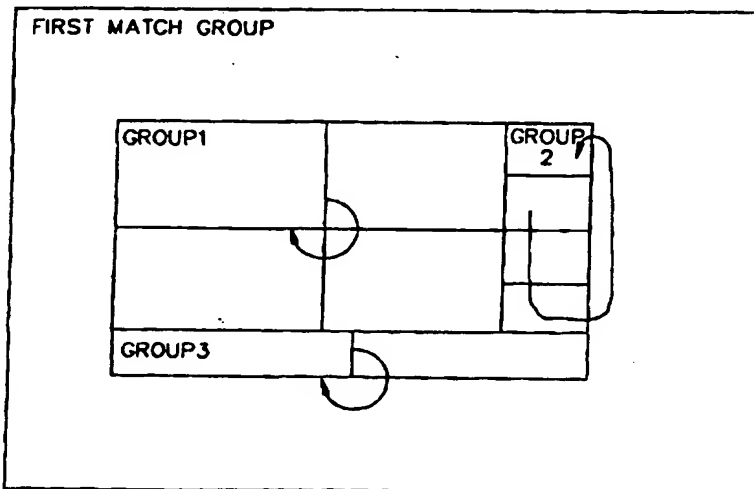
(71) Applicant: HONEYWELL INC. [US/US]; Honeywell Plaza,
Minneapolis, MN 55408 (US).(72) Inventors: ADAMS, James, S.; 509 East Utopia Road,
Phoenix, AZ 85024 (US). MOORE, David, W.; 2901 East
Friess Drive, Phoenix, AZ 85032 (US). HUNTINGTON,
James, C.; 6141 North 16th Drive, Phoenix, AZ 85015 (US).
HOLLAND, Richard, C.; 4425 East Monte Cristo Avenue,
Phoenix, AZ 85032 (US).(74) Agent: MIOLOGOS, Anthony; Honeywell Inc., Honeywell
Plaza - MN12-8251, P.O. Box 524, Minneapolis, MN
55440-0524 (US).(81) Designated States: AU, CA, CN, JP, European patent (AT,
BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,
NL, PT, SE).

Published

With international search report.

(54) Title: METHOD FOR CONFIGURING THE DISPLAY PROPERTIES TO BE APPLIED TO PREDETERMINED APPLICATION
DISPLAYS

FIRST MATCH GROUP



(57) Abstract

In a display system having a display surface of one or more physical surfaces, a method configures the display properties applied to predetermined application displays. In the display system, multiple applications are displayed in a coordinated, predetermined area of the display surface. The method comprises the steps of defining display properties of each window within each group. The display properties thus defined are stored in a configuration file. When an input request is received by the display system to output a predetermined application display, the application display is created in accordance with the size parameters defined in the configuration file. A window within the defined group for the application display is selected from the configuration file in accordance with the selection scheme defined in the configuration file.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon	KR	Republic of Korea	PL	Poland		
CN	China	KZ	Kazakstan	PT	Portugal		
CU	Cuba	LC	Saint Lucia	RO	Romania		
CZ	Czech Republic	LI	Liechtenstein	RU	Russian Federation		
DE	Germany	LK	Sri Lanka	SD	Sudan		
DK	Denmark	LR	Liberia	SE	Sweden		
EE	Estonia			SG	Singapore		

METHOD FOR CONFIGURING THE DISPLAY PROPERTIES
TO BE APPLIED TO PREDETERMINED APPLICATION DISPLAYS

RELATED APPLICATIONS

5

The present application is related to the following:

1. Patent application, Serial No. _____, entitled "Method for Configuring and Controlling Computer Windows' Display of Multiple Applications";
2. Patent application, Serial No. _____, entitled "Method of Display
10 Categorization in a Multi-Window Display Environment";
3. Patent application, Serial No. _____, entitled "Method for Re-
Invoking Previously Displayed Software Application Displays in a Multi-
Window Environment";
4. Patent application, Serial No. _____, entitled "Method for
15 Constraining the Number of Displays in a Multi-Window Computer
Environment";
5. Patent application, Serial No. _____, entitled "Method for
Constraining the Available Display Surface in which Application Displays
May be Rendered";
- 20 6. Patent application, Serial No. _____, entitled "Method for Controlling
the Presentation of Displays in a Multi-Window Computer Environment";

all of the above being incorporated by reference herein, and all of the above filed on
even date herewith, and all of the above assigned to Honeywell Inc., the assignee of the
present application.

25

BACKGROUND OF INVENTION

The present invention relates to a display system, and more particularly, to a method for configuring, in advance, the display properties to be applied to various applications displays, thereby permitting predictable management of application displays in a multi-display computer environment.

Existing multi-window computer display environments do not provide for generically configuring application display properties. Thus, displays are often “randomly” presented on the screen. The present invention provides a mechanism by which applications can be predictably and intelligently laid out (positioned, sized, etc.) such that multiple independent applications appear to be components of an overall coherent workspace.

The present invention provides a method for configuring display properties, thus lending extensive control and predictability to the operational environment. These display properties are applied to applications, including third-party applications, which typically would not be predictably nor consistently positioned. The result is an ability to provide a high level of integration and coherence across a multiplicity of varied applications into a single, comprehensible, and manageable working environment. Generally, this invention has utility in multiple display computer environments in which critical displays must be protected from occlusion by non-critical displays. The present invention provides operational predictability and simplicity such that displays are presented according to specific predetermined criteria rather than what appears to the operator as “at random”. Also provided is a workspace-wide cohesiveness and coherence to a diverse collection of application displays. High-level, extensive workspace organization capability is afforded.

SUMMARY OF THE INVENTION

Therefore, there is provided by the present invention a method for configuring the display properties to be applied to predetermined application displays. In a display

system having a display surface of one or more physical surfaces, a method configures the display properties applied to predetermined application displays. In the display system, multiple applications are displayed in a coordinated, predetermined area of the display surface. The method comprises the steps of defining display properties of each window within each group. The display properties thus defined are stored in a configuration file. When an input request is received by the display system to output a predetermined application display, the application display is created in accordance with the size parameters defined in the configuration file. A window within the defined group for the application display is selected from the configuration file in accordance with the selection scheme defined in the configuration file.

Accordingly, it is an object of the present invention to provide a method for configuring the display properties of application displays.

It is another object of the present invention to provide a method for configuring in advance the display properties to be applied to a plurality of application displays, thereby permitting predictable management of application displays in a multi-display computer environment.

These and other objects of the present invention will become more apparent when taken in conjunction with the following description and attached drawings, wherein like characters indicate like parts, and which drawings form a part of the present application.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of a process control system of the preferred embodiment in which the present invention can be utilized;

Figure 2 shows a block diagram of common elements of each physical module of the process control system of Figure 1;

Figure 3 shows a functional block diagram of a typical physical module of the process control system;

Figure 4 shows a block diagram of a Workspace Manager Display System of the preferred embodiment;

Figure 5 shows the layout of an example configuration of a display of the Workspace Manager System (WSM), each window representing a different set of configured display characteristics, including but not limited to, the shown window locations and sizes.

Figure 6 shows an example ordering by which a newly-invoked application display area is related to a specific set of display characteristics for the example of Figure 5;

Figure 7, which comprises Figures 7A and 7B, shows a flow diagram of the WSM software operating in the Workspace Manager Display System in which the method of the present invention is utilized; and

Figure 8 shows a sample configuration file for a two-window, round-robin workspace.

DETAILED DESCRIPTION

Before describing the method of the present invention, it will be helpful in understanding a system environment in which the invention is utilized. Referring to Figure 1, there is shown a block diagram of a process control system 10 of the preferred embodiment in which the present invention can be found. The process control system 10 includes a plant control network 11, and connected thereto is a data hiway 12, which permits a process controller 20' to be connected thereto. In the present day process control system 10, additional process controllers 20' can be operatively connected to the plant control network 11 via a corresponding hiway gateway 601 and a corresponding data

hiway 12. A process controller 20, an interface apparatus which includes many new additions, improvements, and features over the process controller 20', is operatively connected to the plant control network 11 via a universal control network (UCN) 14 to a network interface module (NIM) 602. In the preferred embodiment of the process control system 10 additional process controllers 20 can be operatively connected to the plant control network 11 via a corresponding UCN 14 and a corresponding NIM 602. The process controllers 20, 20' interface the analog input and output signals and digital input and output signals (A/I, A/O, D/I, and D/O respectively) to the process control system 10 from the variety of field devices (not shown) of the process being controlled which include valves, pressure switches, pressure gauges, thermocouples,

The plant control network (or more simply network) 11 provides the overall supervision of the controlled process in conjunction with the plant operator and obtains all the information needed to perform the supervisory function and includes an interface with the operator. The plant control network 11 includes a plurality of physical modules (or nodes), which include a universal operator station (US) 122, an application module (AM) 124, a history module (HM) 126, a computer module (CM) 128, and duplicates (backup or secondary) of these modules (and additional types of modules, not shown) as necessary to perform the required control/supervisory function of the process being controlled. Each of these physical modules is operatively connected to a local control network (LCN) 120, which permits each of these modules to communicate with each other as necessary. The NIM 602 and HG 601 provide an interface between the LCN 120 and the UCN 14 and the LCN 120 and the data hiway 12, respectively.

Physical modules 122, 124, 126, 128, . . . of network 11 of the preferred embodiment are of various specialized functional types. Each physical module is the peer, or equivalent, of the other in terms of right of access to the network's communication medium, or LCN 120, for the purpose of transmitting data to other physical modules of network 11.

30

Universal operator station module (US) 122 of network 11 is a workstation for one or more plant operators.

A history module (HM) 126 provides mass data storage capability. The history module 126 includes at least one conventional disk mass storage device, such as a Winchester disk, which disk storage device provides a large volume of nonvolatile storage capability for binary data. The types of data stored by such a mass storage device are typically trend histories, event histories, . . . or data from which such histories can be determined, data that constitutes or forms CRT type displays, copies of programs for the physical modules

An application module (AM) 124 provides additional data processing capability in support of the process control functions performed by the controllers associated with the process control subsystem 20, 20' such as data acquisition, alarming, batch history collection, and provide continuous control computational facilities when needed. The data processing capability of the application module 124 is provided by a processor (not shown) and a memory (not shown) associated with the module.

Computer module (CM) 128 uses the standard or common units of all physical modules to permit a medium-to-large scale, general purpose data processing system to communicate with other physical modules of network 11 and the units of such modules over the LCN 120 and the units of process control subsystems 20, 20' via the hiway gateway module 601, and the NIM 602, respectively. Data processing systems of a computer module 128 are used to provide supervisory, optimization, generalized user program preparation, and execution of such programs in higher-level program languages. Typically, the data processing systems of a computer module 128 have the capability of communicating with other such systems by a communication processor and communication lines.

The local control network 120 (LCN) is a high-speed, bit serial, dual redundant communication network that interconnects all the physical modules of plant control network 11. LCN 120 provides the only data transfer path between the principal sources of data, such as hiway gateway module 601, application module 124, and history module 126, and principal users of such data, such as universal operator station module 122,

computer module 128, and application module 124. LCN 120 also provides the communication medium over which large blocks of data, such as memory images, can be moved from one physical module, such as history module 126, to universal station module 122. LCN 120 is dual redundant in that it consists of two coaxial cables that permit the serial transmission of binary signals over both cables.

Referring to Figure 2, there is shown a block diagram of the common elements of each physical module of the network 11 or the process control system 10. Each of the physical modules includes a module central processor unit 38 and a module memory 40, a random-access memory (not shown), and such additional controller devices, or units (not shown), which are configured to provide the desired functionality of that type of module, i.e., that of the operator station 122, for example. The data-processing capabilities of each module's CPU 38 and module memory 40 create a distributed processing environment which provides for improved reliability and performance of network 11 and process control system 10. The reliability of network 11 and system 10 is improved because, if one physical module of network 11 fails, the other physical modules will remain operational. As a result, network 11 as a whole is not disabled by such an occurrence as would be the case in centralized systems. Performance is improved by this distributed environment in that throughput and fast operator response times result from the increase computer processing resources and the concurrency and parallelism of the data-processing capabilities of the system.

As mentioned above, each physical module includes the BUS interface unit (BIU) 32, which is connected to the LCN 120 by the transceiver 34. Each physical module is also provided with the module BUS 36 which, in the preferred embodiment, is capable of transmitting 16 bits of data in parallel between the module CPU 38 and the module memory 40. Other units, utilized to tailor each type of physical module to satisfy its functional requirements, are operatively connected to module BUS 36 so that each such unit can communicate with the other units of the physical module via its module BUS 36. The BIU 32 of the physical module initiates the transmission of data over LCN 120. In the preferred embodiment, all transmissions by a BIU 32 are transmitted over the coaxial cables which, in the preferred embodiment, form the LCN 120.

Referring to Figure 3 there is shown a functional block diagram of a typical physical module 122, 124, 126, 128 of the plant control network 11, and includes the BUS 32 and the transceiver 34, which connects BIU 32 to the LCN 120. BIU 32 is capable of transmitting binary data over LCN 120 and of receiving data from LCN 120. Transceiver 34, in the preferred embodiment, is transformer coupled to the LCN 120. In the preferred embodiment, the LCN 120 is a dually-redundant coaxial cable with the capability of transmitting bit serial data. BIU 32 is provided with a very fast micro-engine 56. In the preferred embodiment, micro engine 56 is made up of bit slice components so that it can process eight bits in parallel and can execute a 24 bit microinstruction from its programmable read only memory (PROM) 58.

Signals received from the LCN 120 are transmitted by transceiver 34 and receive circuitry 52 to receive FIFO register 54. Micro engine 56 examines the data stored in FIFO register 54 and determines if the information is addressed to the physical module. If the data is an information frame, the received data is transferred by direct memory access (DMA) write circuitry 66 by conventional direct memory access techniques to the physical module memory unit (MMU) 40 over module BUS 36.

Communication between MCPU processor 68, a Motorola 68020 microprocessor in the preferred embodiment, and other functional elements of MCPU 38 is via local microprocessor BUS 39. Module BUS interface element 41 provides the communication link between local BUS 39 and module BUS 36. Processor 68 executes instructions fetched from either its local memory 43, in the preferred embodiment an EPROM, or from MMU 40. Processor 68 has a crystal controlled clock 45 which produces clock pulses, or timing signals. Input/output (I/O) port 49 provides communication between MCPU 38 and equipment external to the physical module to permit program loading and the diagnosis of errors, or faults, for example.

Each MCPU 38 includes a timing subsystem 48 which, in response to clock signals from module clock 45, produces fine resolution, synchronization, and real-time, timing signals. Any timing subsystem 48, which is provided with a timing subsystem

driver 50, has the capability of transmitting timing information to other physical modules over the LCN 120. Another input to each timing subsystem 48 is timing information which is transmitted over LCN 120 and which is received through transceiver 34, timing receiver 55, and timing driver 57 of BIU 32. Timing pulses from module power supply 59, which are a function of the frequency of the external source of A.C. electric power applied to power supply 59, are used by timing subsystem 48 to correct longer-term frequency drift of the clock pulses produced by clock 45.

Additional information of the BIU 32 can be found in U.S. Patent No. 4,556,974. A more detailed description of the process control system 10 can be had by referring to U.S. Patent No. 4,607,256. Additional information of the individual, common, functional blocks of the physical modules can be had by reference to U.S. Patent No. 4,709,347, all of the above-identified patents being assigned to the assignee of the present application; and additional information of the process controller 20' can be had by referencing U.S. Patent No. 4,296,464.

The addition of an interface apparatus which interfaces other systems to the process control system 10 described above and a modification to a graphics generator in the US 122 opens up the existing system, specifically the graphics interface, which includes designing-in the capability to readily permit nodes of differing designs to communicate to the network. In order to open up the graphics interface such that a display which is not on the LCN can be displayed onto the CRT 151 of the US 122, there is included an interface to a graphics card of the US 122 from a co-processor. For more detailed information regarding the opening of the graphics interface, reference can be made to U.S. Patent No. 5,386,503, entitled "Method for Controlling Window Displays in an Open Systems Windows Environment," and to U.S. patent No. 5,530,844, entitled "Method of Coupling Open Systems to a Proprietary Network," both patents being assigned to the same assignee of the present application.

The display system which incorporates the method of the present invention will now be described. Referring to Figure 4, there is shown a block diagram of a Workspace Manager (WSM) Display System of the preferred embodiment of the present invention.

The Workspace Manager Display System, or more simply referred to as Workspace Manager 124, is coupled to the LCN 120 of the process control system 10 in the preferred embodiment. The Workspace Manager (WSM) 124 is a personal computer (PC) which can be purchased in the marketplace, and includes an LCN co-processor 127 coupled to the LCN 120 and to an internal BUS (PCBUS) 131 of the PC (i.e., of the WSM 124). The LCN co-processor 127 includes the BIU 32, the module BUS 36, the module CPU 38, and the module memory 40, described above. This configuration permits the WSM 124 to communicate with the LCN 120 and the nodes connected thereto. The WSM 124 includes a graphics card 132 coupled to a display 125 and to the PC BUS 131. An Ethernet card 133 permits the WSM 124 to communicate with foreign systems (i.e., systems not coupled to the LCN 120). A microprocessor (mr) 134 of the PC is coupled to the PC BUS 131 and executes the Windows NT Operating System and the Workspace Manager software. A WSM memory 135 is also coupled to the PC BUS 131 and stores the various information (including a configuration file, which will be described later) for use by the mr 134. A keyboard 130 is included for inputting commands to the WSM 124. A mouse interface 136 is provided in the preferred embodiment of the WSM 124.

In order to display a number of windows in an orderly, controlled manner, the display 125 is configured (or mapped) in a predetermined manner. Referring to Figure 5, there is shown an example of a configuration of a display screen (not shown), sometimes referred to as a display surface, of display 125 of WSM 124. The display screen (or workspace) is divided into three categories: schematics, trends, and alarms. This workspace is configured as follows:

- Schematics are limited to the region in which the four initial windows are displayed.
- Trends are positioned along the right side of the workspace in fixed locations.
- Alarms are presented at the bottom of the display.

In the preferred embodiment, the schematic invocation never results in the removal of alarm or trend display and vice versa. In the title area, note that the normal windows functions, such as MIN, MAX, . . . , features are included.

In the microprocessor 134 of WSM 124 there is operating a workspace management program (i.e., software) which in the preferred embodiment is a Windows NT, provided by the Microsoft Corp., which has been modified as will be described hereinunder. In order to achieve the configuration as shown in Figure 5, a window specification file (sometimes referred to as a configuration file) is provided to the workspace management software. The window specification is a set of window properties which can be applied to one or more real-application windows during runtime. Some of these properties, such as position, relate to existing windows concepts. Other properties, such as region and draggable, represent extended means of controlling application windows. A plurality of window specifications can be included in a given workspace configuration. At runtime, once the workspace manager associates a real-application window with a particular window specification, that specification's properties are applied and enforced for that application window. This will be further described hereinunder.

In accordance with the examples shown above, Figure 6 shows the workspace groups and how the space is selected by the workspace manager program. The window specifications are organized into logical window groups for each workspace configuration. Each workspace configuration consists of a single top-level group, consisting of one or more window specifications, and/or subgroups. Thus, a hierarchy of window groupings is possible. Each window group must be configured with one of three possible strategies for searching the matching window specification. Each of these strategies embodies a unique approach to determining the criteria by which a given application display will be managed and providing a new kind of functionality which is included as part of this invention: The automatic replacement of existing displays by newly-invoked displays (determining which existing display is to be replaced with a newly invoked display). A round-robin group uses a "round robin" approach in selecting which of its window specifications is applied to a given application window. This group is intended to support a cyclical replacement style in which the newest application window appears to replace the oldest one. All window specifications of this type of group share a common match expression so that a similar set of applications can easily match to each window in a group. Therefore, the match expression concept is applied at the group level for the round-robin groups. A "manual-select" group is similar to the round-robin group in that all applications displayed

in this group share a common match expression; however, this group does not automatically increment the window specification which should be used to manage the next application display which matches the group's match expression. Rather, the system allows the user to manually select where the next application display will appear, and all newly-invoked applications which belong to this group will continue to replace the manually-selected application until another application is manually selected. Applications are "selected" for replacement via special title-bar buttons which are included as part of this invention. The "first match" group is designed to search its list of subgroups and window specifications in a "top-down, depth-first" fashion. All items in this group, including individual window specifications, each have their own match expression. In the preferred embodiment, all three groups of the example of Figure 5 are of the round-robin group type and is so indicated in the window specification file (or sometimes called herein configuration file).

Referring to Figure 7, which comprises Figures 7A and 7B, there is shown a flow diagram of the WSM software operating in the Workspace Manager Display System of the present invention. A display of an application is requested via the keyboard 126 (or via a mouse interface with a corresponding display, not shown). The program operating within the Workspace Manager Display System 124 is essentially waiting for an input (Block 902). Once the input is received via the keyboard (or via the mouse), the message is decoded (Block 903) and branches to point X (Block 900) if a new display window of an application is requested (Block 900), or branches to point Y in Figure 7B if a current display is being operated, on or being manipulated (Block 912). The requested display is created (Block 901) and the operating system creates the window which incorporates the requested display (Block 904). Within the window, any miscellaneous request made by the operator is also set up in the display (Block 905); and if no specific display parameters have been requested, default conditions will be utilized to set up the display (Block 906). If the workspace manager is not involved (i.e., is not to manage the display) or is inoperative or is optionally turned off, the display as requested and as set up appears on the display screen of the display 125 (Block 909), and the program exits to wait state (Block 902). If, however, the workspace manager is to control the display (Block 908), the display is modified in accordance with the workspace manager configuration file (or

sometimes referred to herein as the window specification file) (Block 907). The configuration file is stored within the Workspace Manager Display System 124 and is generated offline and contains the parameters which define the workspace area of the display screen. In particular, the location on the display screen is modified such that the requested display appears in the next available window of the Window 1, Window 2, . . . , Trend 1, . . . , or Alarm 1 . . . , in the example of Figure 5. If the requested display is to replace an existing display (Block 910), the existing display is closed (Block 911) and the program continues to Block 909, in which the display appears in the controlled format and within the controlled, predetermined area, and the program then exits to the wait loop. If an existing display is not to be replaced, the program branches immediately to Block 909, the display appears, and the program exits to Block 902. In the preferred embodiment of the present invention, provision exists for replacing an old display with a newly-requested display. However, it will be understood by those skilled in the art that many variations can be made with the replacement of a display, such as having a priority associated with the display whereby a display of a lower priority cannot replace a display of a higher priority. In addition, displays may be marked by an operator as not being replaceable, It will be understood that many such features and variations thereof exist which are within the scope of the present invention.

If a display is being managed, i.e., operated on or modified (Block 912), the display is checked to determine if the operation is a move, size, stretch, . . . , being requested by the user or the application (Block 913). Before the application visually reflects the results of such an operation, the standard windows operating system (OS) of the WSM software signals its intent to redraw the display with the new coordinates (Block 914). If the display is being managed by the workspace manager, a determination is made whether the new coordinates violate the configuration file (the window specification file) (Block 916). If the coordinates are outside the configuration file, the coordinates are modified to bring them into compliance with the configuration file (Block 915). At Block 914, when the operating system redraws the display with the new coordinates and the display is not being managed by the workspace manager, the display appears in the requested coordinates (Block 917) and the program exits to the wait loop (Block 902). If the new coordinates in Block 916 do not violate the configuration file, the program

proceeds to display the requested modified display in the requested coordinates (Block 917), and the program exits to the wait loop (Block 902). After the display modifies the coordinates in Block 915 to bring them into compliance with the configuration file, the display appears in the modified coordinates (Block 918) and the program exits to the wait loop (Block 902).

It will be recognized by those skilled in the art that the software of the program manager can be a completely new software package programmed to perform the functions as described in Figure 7. Also, it will be recognized by those skilled in the art that the standard windows operating system (OS) can be utilized and modified in order to incorporate the features of the workspace manager display system as described herein. The window specification file, or configuration file, is a file stored within the WSM memory 135 of the WSM 124. There can be a plurality of configuration files to define various workspace configurations, including a four-window workspace; a five-window workspace, which is similar to a four-window workspace with the fifth workspace having a critical space (or group); a ten-window, three-group workspace, as shown in Figure 5, . . . Each entry into the configuration file includes the size of the window, the position of the window, . . . , and/or other characteristics which define the parameters and properties of the window. Although the applications being displayed in the preferred embodiment are process-control related, it will be further understood by those skilled in the art that the application can be any application being monitored, e.g., financial applications when financial systems are being monitored, manufacturing plant operations when utilized in manufacturing operations,

In the present invention, the window/displays are generated by the logic of the Workspace Manager System in accordance with the information as set forth in the configuration file, as described above. Referring to Figure 8, there is shown a sample configuration file for a two-window, round-robin workspace. The parameters (or sometimes referred to as properties) are shown in an english word/expression form, but it will be understood by those skilled in the art that this information resides in a memory unit of the display system in a form readable and comprehensible to the Workspace Manager System.

The workspace configuration file includes:

Workspace (NAME)

0 or more constant definitions

5 0 or more application launch commands

1 Group Definition

End Workspace

Group Definition

10 Group (NAME) (type, i.e., round robin, manual, first match)

0 or 1 match expression

0 or 1 region expression

0 or more Window Definition

End Group

15

Window Definition

Window (WINDOW NAME)

0 or 1 match expression

0 or more Window Properties

20 End Window

The window properties include:

Region = x, y, width, height

Always on top = true/false

25 Draggable = true/false

Maxsize = width, height

Minsize = width, height

Sizable = true/false

Position = x, y

30 Size = width, height

Placeholder = true/false

Minimizable = true/false

Maximizable = true/false

Closeable = true/false

The definition of the window properties are:

5 Region = x, y, width, height: Indicates the display area outside of which this window cannot be moved or sized. Even if the window is maximized, it will not be displayed with dimensions which exceed these bounds. The region may be specified at the group level for round robin and manual select groups and inherited by window specifications. If specified at the window-specification level, this region overrides the group's region value.

10 Always on top = true/false: Indicates whether the window shall have the "topmost" window style. Topmost windows are never occluded by non-topmost windows but may be occluded by other topmost windows. The Microsoft Clock application is a typical example of an "always on top" application. If set false, this style can be removed from normally always on top applications, such as the Clock.

15 Draggable = true/false: Indicates whether the window can be dragged by the user. Note that this property does not completely preclude moving a window unless the *sizable* property is also set to false.

20 Maxsize = width, height: Indicates the maximum width and height to which this window is permitted to grow. This value similarly constrains the size of a maximized window.

Minsize = width, height: Indicates the minimum width and height to which this window is permitted to shrink.

25 Sizable = true/false: Indicates whether this window can be sized by the user. If this value is false, the style of the window is changed to "thin frame," providing visual cues that this window cannot be sized.

30 Position = x, y: Indicates the initial position (upper-left corner coordinates) at which this window will be displayed. Note that this value must be within the region if it is specified. Also, upon "original positions" command, the Workspace Manager System repositions this window back to this position.

Size = width, height: Indicates the initial width and height values applied to this window upon presentation. Upon "original positions" command, the window is repositioned to its original position and size.

5 Placeholder = true/false: Indicates whether a blank "placeholder window" is displayed, according to this window specifications' properties, when no application is currently displayed using this window specification.

Minimizable = true/false: Provides the ability to remove MIN button from the display.

10 Maximizable = true/false: Provides the ability to remove the MAX button from the display.

Closeable = true/false: Provides the ability to inhibit closing of an application display.

15 The pointer is a value which points to the next window to have a display inserted in the round-robin scheme. The pointer is utilized by the Workspace Manager System in making the next window determination. There is a pointer for each group and it is maintained by the Workspace Manager System in a manner well known to those skilled in the art.

20 Also, the discussion above is to an example of a single-group, round-robin type. As mentioned previously, additional groups can be specified, additional windows per group be specified,

25 While there has been shown what is considered the preferred embodiment of the present invention, it will be manifest that many changes and modifications can be made therein without departing from the essential scope and spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications that fall within the true scope of the invention.

CLAIMS

Claim 1. In a display system having a display surface of one or more physical surfaces, a method configuring the display properties applied to predetermined application displays, wherein multiple applications are displayed in a coordinated, predetermined area of the display surface, the method comprising the steps of:

- a) defining display properties of each window within each group;
- b) storing the display properties in a configuration file;
- c) when an input request is received by the display system to output a predetermined application display, creating the application display in accordance with size parameters defined in said configuration file; and
- d) selecting a window within the defined group for the application display in accordance with the selection scheme defined in the configuration file.

Claim 2. A method of configuring the display properties applied to predetermined application displays according to Claim 1, wherein said selection scheme comprises at least one type, including round robin, manual, and first match.

Claim 3. A method of configuring the display properties applied to predetermined application displays according to Claim 2, wherein said round-robin type of selection scheme utilized a pointer to the next window in the configuration to be used for outputting the application display.

Claim 4. A method of configuring the display properties applied to predetermined application displays according to Claim 1, wherein said display properties include size and placement parameters and Boolean-type parameters indicating whether a predetermined operation is permitted on the corresponding application display.

Claim 5. A method of configuring the display properties applied to predetermined application displays according to Claim 4, wherein said display properties define a region for constraining the display of the corresponding application display.

1/9

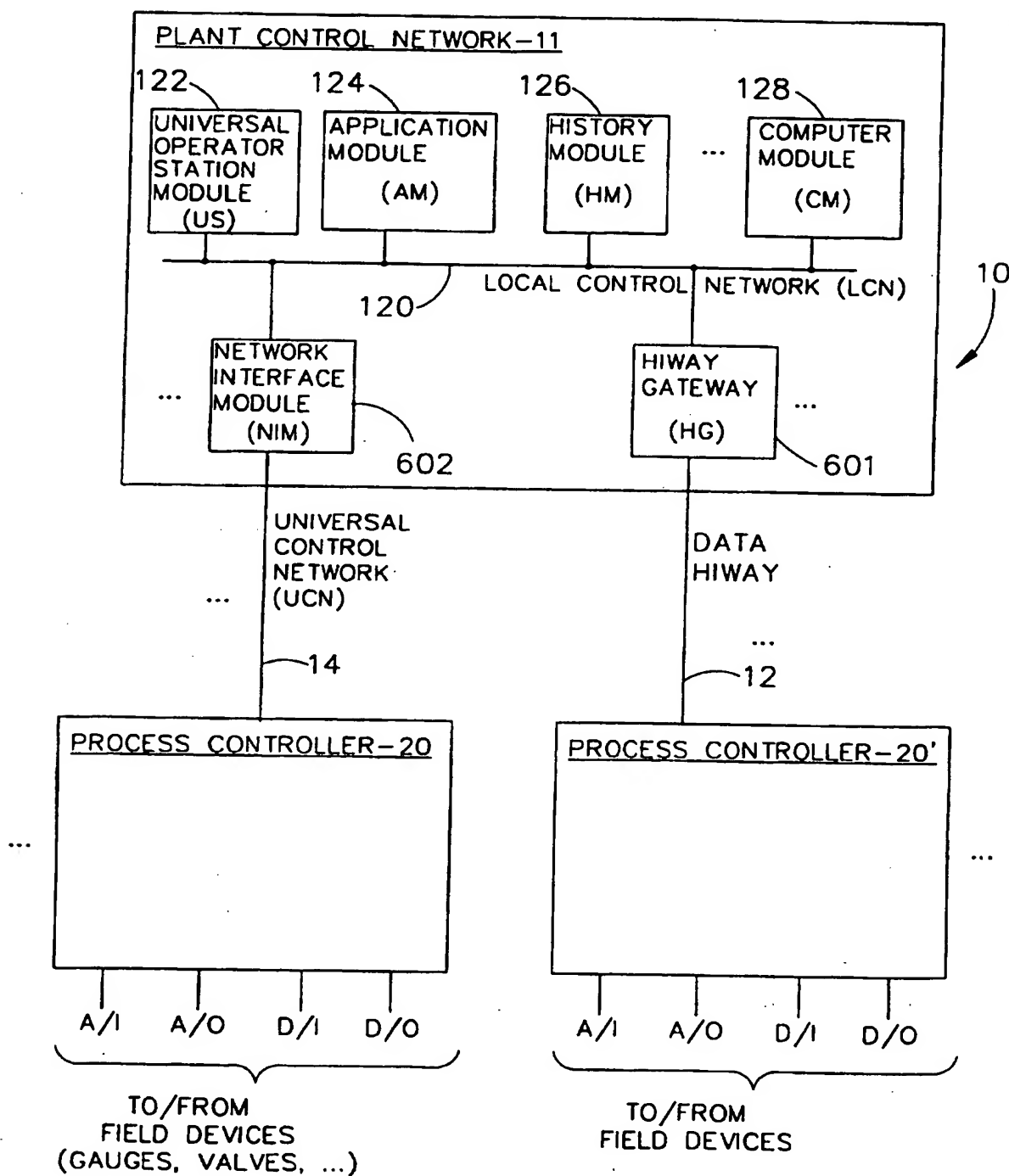


Fig. 1

2/9

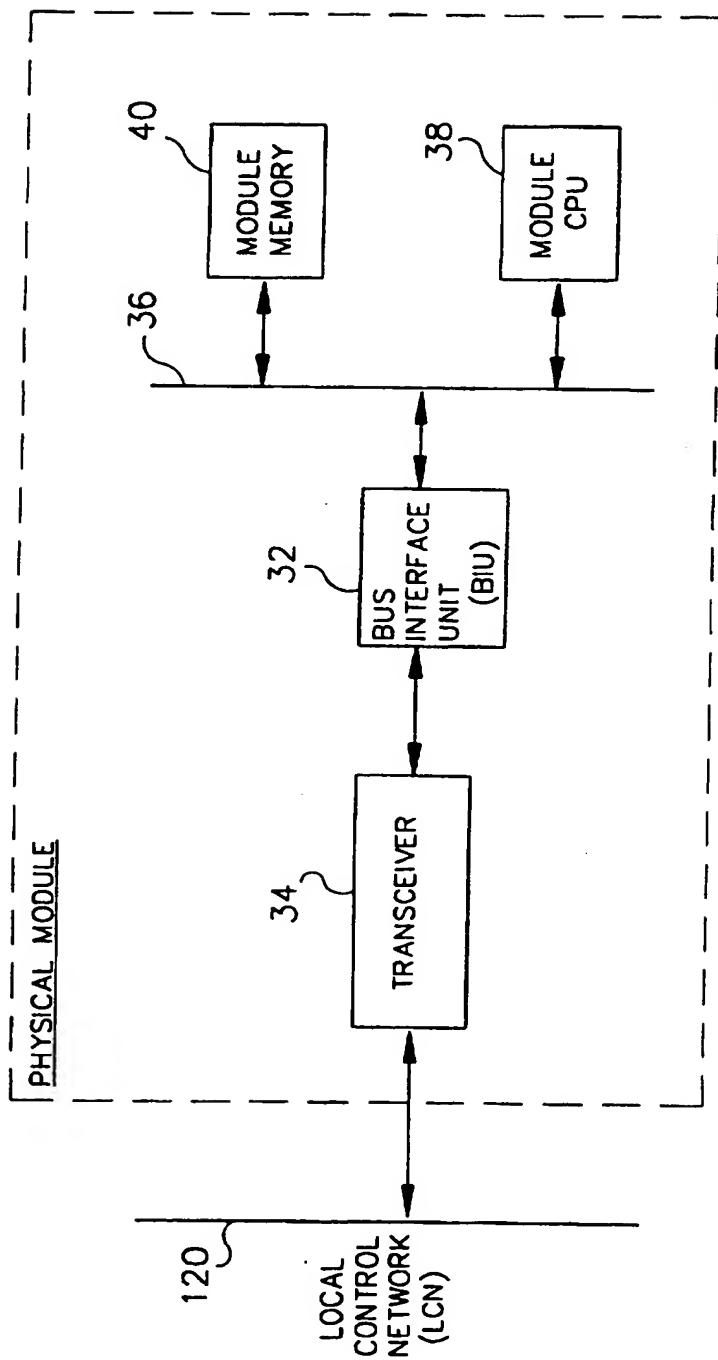


Fig. 2

3/9

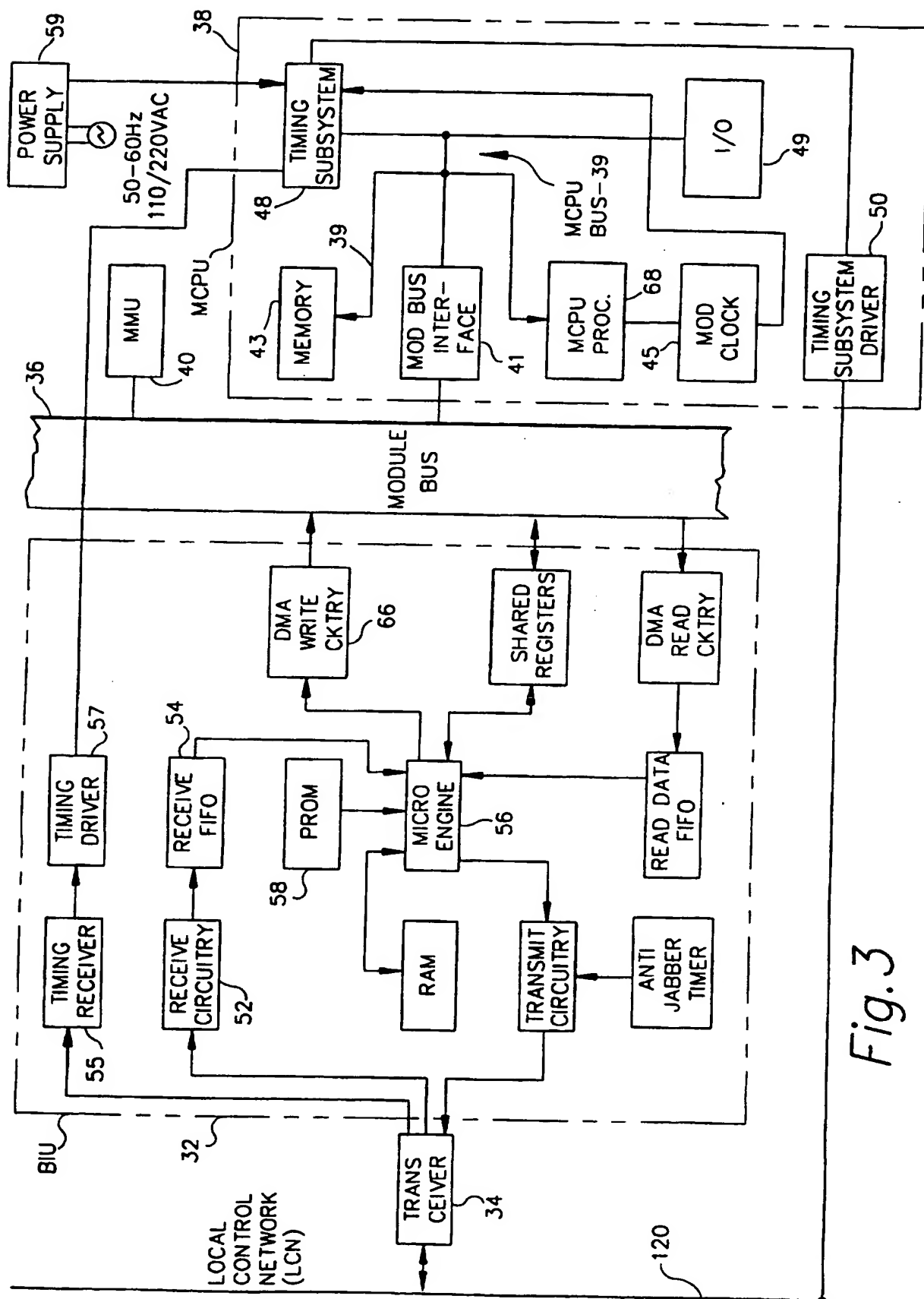
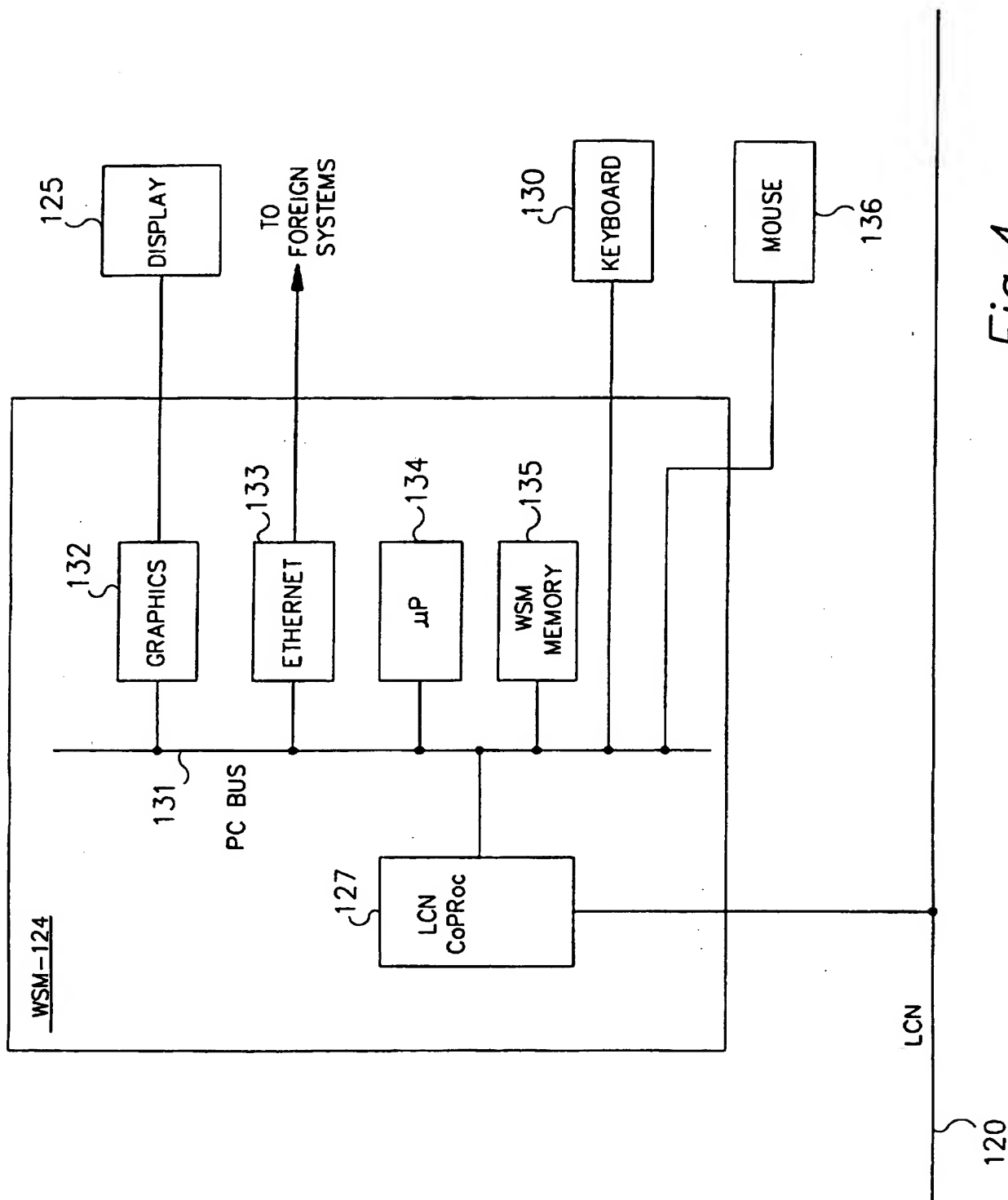


Fig. 3

4/9



5/9

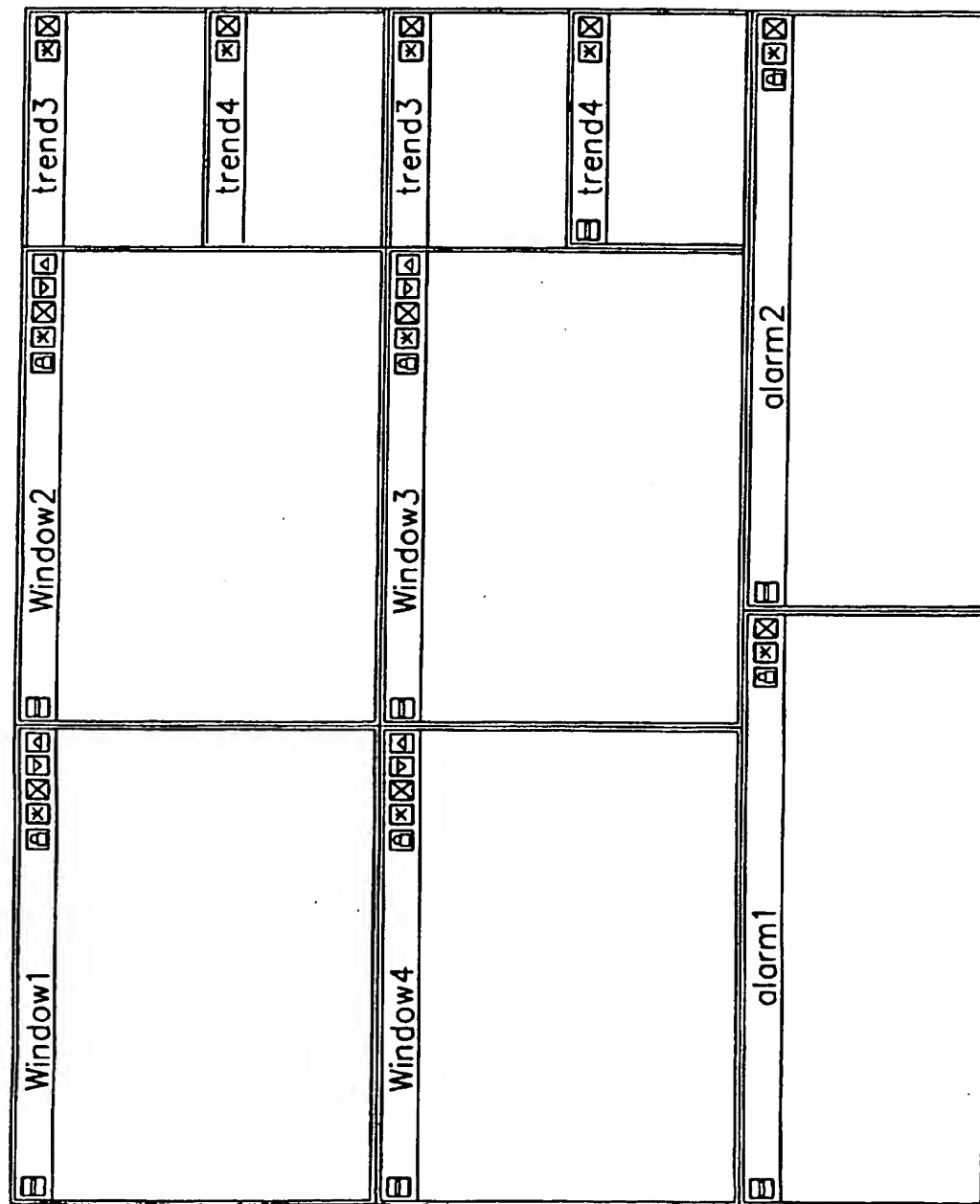


Fig. 5

6/9

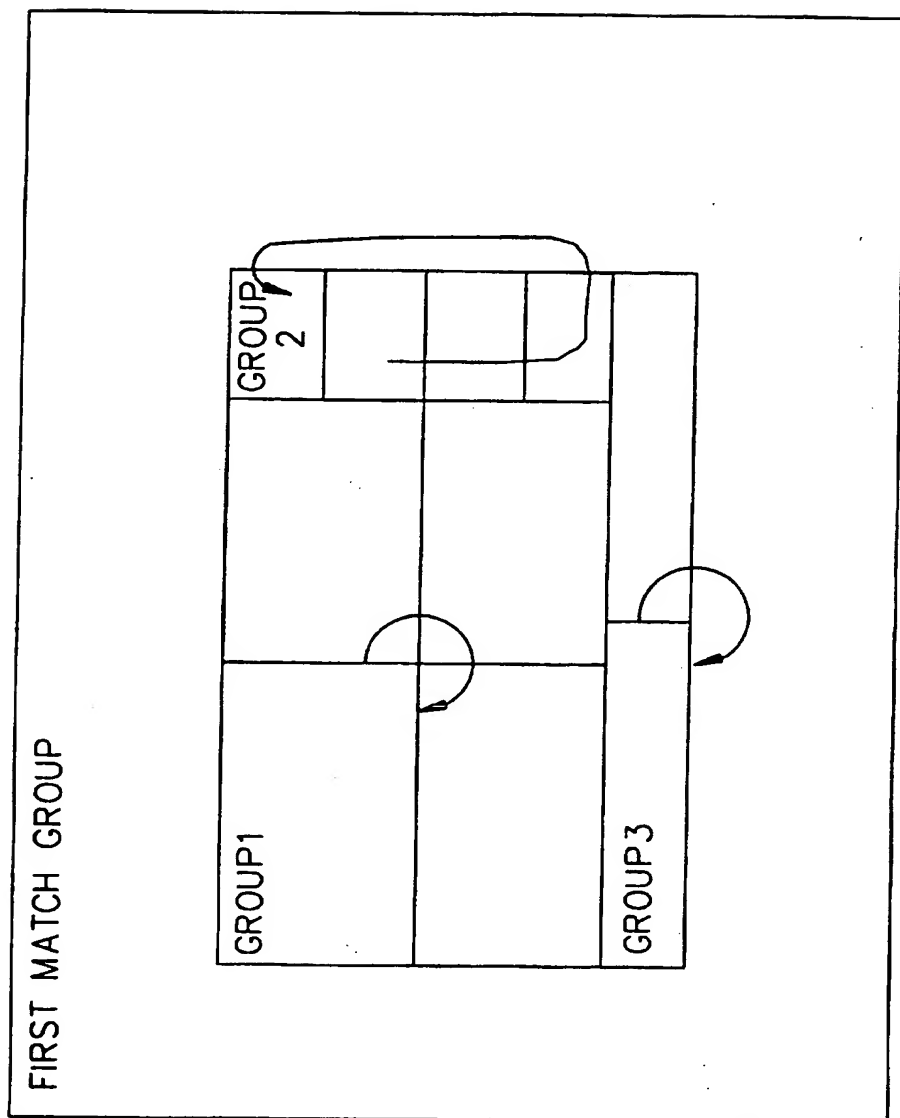


Fig. 6

7/9

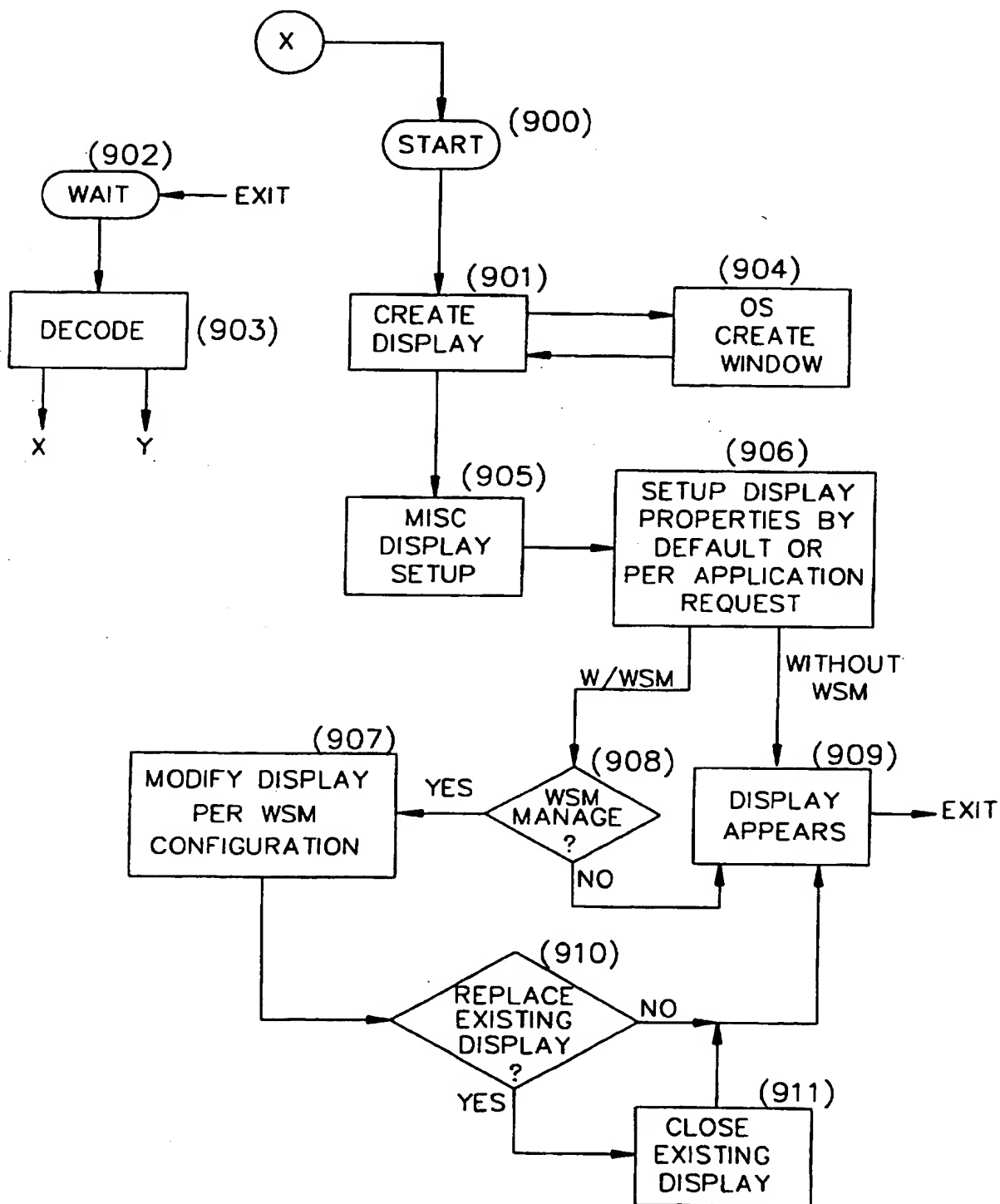
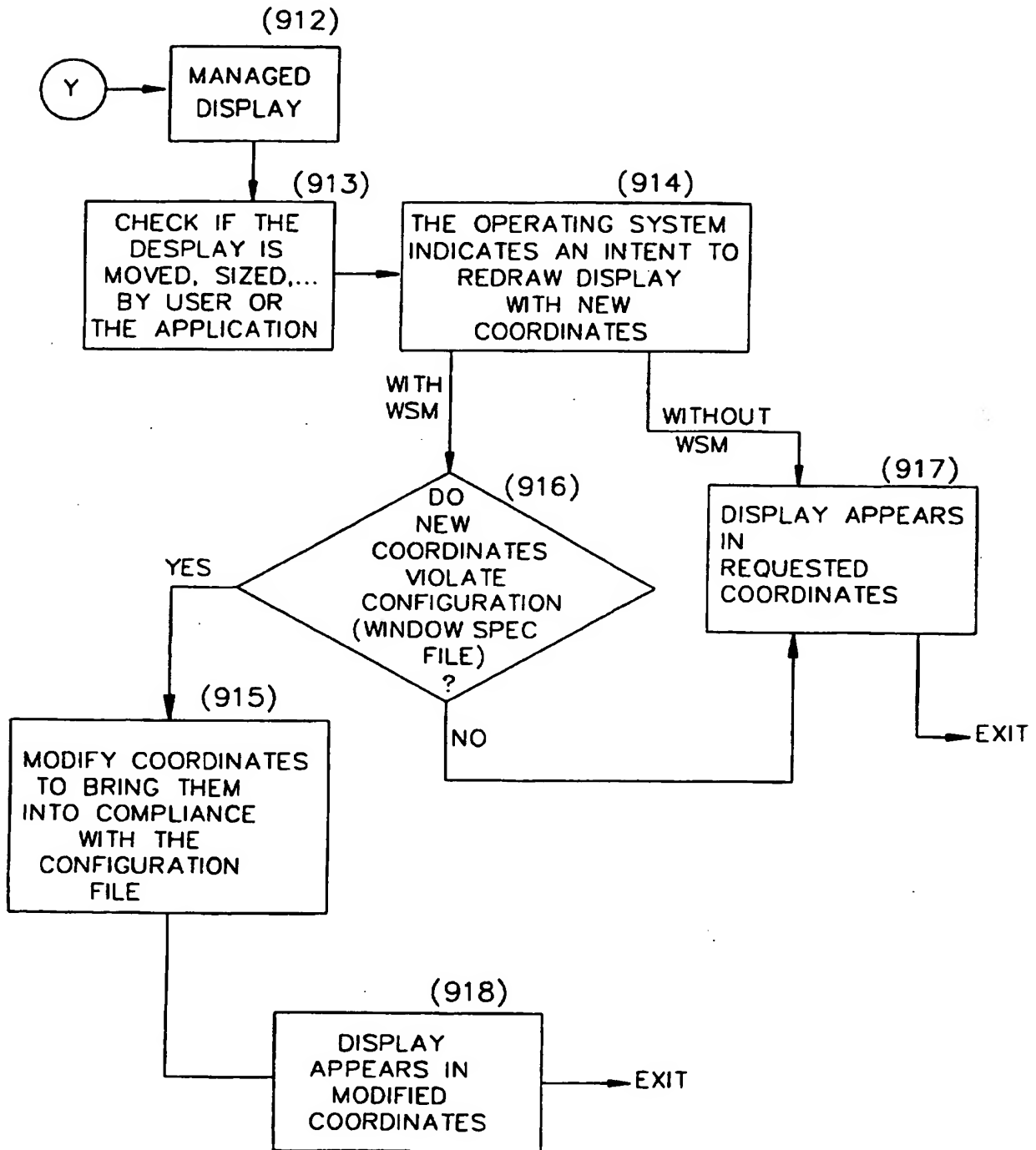


Fig. 7A

8/9

*Fig. 7B*

9/9

TWO WINDOW, ROUND ROBIN WORKSPACE

// Workspace Manager-Configuration file-WSMDEMO.WDL
 //-Description: "A Simple operator workspace"
 -Two window operator workspace with placeholder windows

```
workspace operator_views
//Workspace dimension constants
  number wswidth=1150      ;
  number wsheight=845     ;
  number xOffset=2;
  number yOffset=19;
```

```
//Begin actual workspace definition
  group Unit1 ("round robin")
    match=category("?*") or title("File Man?*") or
      title("Mirosoft Wor?*");
```

POINTER → window Window1

```
    always on top=no;
    draggable=yes;

    placeholder=yes;
    sizeable=no;
    position=xOffset,yOffset;
    size=wswidth/2, wsheight/2;
    region=xOffset,yOffset,wswidth,wsheight;
  end window

  window Window2
    always on top=no;
    draggable=yes;

    placeholder=yes;
    sizeable=no;
    position=xOffset+wswidth/2,yOffset;
    size=wswidth/2, wsheight/2;
    region=xOffset, yOffset, wswidth ,wsheight ;
  end window
end group
end workspace
```

Fig. 8

INTERNATIONAL SEARCH REPORT

National Application No

PCT/US 97/16215

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G06F3/033 G06F9/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	EP 0 558 224 A (IBM) 1 September 1993 see abstract see column 3, line 35 - line 55; figures 1,3-5,8-12 see column 4, line 50 - column 5, line 47 see column 6, line 21 - column 9, line 41 ---	1,2,4,5 3
Y A	US 5 487 143 A (SOUTHGATE TIMOTHY J) 23 January 1996 see column 3, line 26 - line 51 see column 5, line 9 - column 15, line 29; figures 3-8 ---	1,2,4,5 3
A	US 5 386 503 A (STAGGS KEVIN P ET AL) 31 January 1995 cited in the application see the whole document -----	1-5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

19 December 1997

Date of mailing of the international search report

02/01/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Fonderson, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

I. International Application No

PCT/US 97/16215

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0558224 A	01-09-93	JP 2106073 C	06-11-96
		JP 5289840 A	05-11-93
		JP 7111675 B	29-11-95
		US 5689665 A	18-11-97
US 5487143 A	23-01-96	US 5561757 A	01-10-96
US 5386503 A	31-01-95	AU 4013293 A	23-12-93
		CA 2097563 A	17-12-93
		EP 0575150 A	22-12-93
		JP 6208522 A	26-07-94